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Gotay, Mark J.; **Nester, James M.**

Presymplectic Lagrangian systems. I. The constraint algorithm and the equivalence theorem.

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A Lagrangian system is a triple (TQ, L, Ω), where Q is a manifold, TQ its tangent bundle, L a real-valued function on TQ (the Lagrangian), and Ω the presymplectic 2-form on TQ defined in canonical coordinates (q^i, v^i) on TQ by $\Omega = (\partial^2 L/\partial v^i \partial q^j) \cdot dq^i \bigwedge dq^j + (\partial^2 L/\partial v^i \partial v^j) \cdot dq^i \bigwedge dv^j$. A special Hamiltonian system is a triple (M_1, H_1, ω_1), where $M \subset TQ$ is a submanifold, H_1 a real-valued function on M_1 (the Hamiltonian), and ω_1 a presymplectic form on M. The authors prove the following equivalence theorem. Let (TQ, L, Ω) be an almost regular Lagrangian system, $FL\colon TQ \to T^*Q$ the Legendre transformation defined by L; then (1) there exists a special Hamiltonian formulation $(FL(TQ), H_1, \omega_1)$ of the dynamics of the system, and (2) the Lagrangian and Hamiltonian formulations are equivalent. The proof is based on a constraint algorithm given by the authors and G. Hinds [J. Math. Phys. **19** (1978), no. 11, 2388–2399; MR0506712 (80e:58025)].

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